

OBSERVATIONS ON RENAL AND URETERAL CALCULI.*

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OF the many interesting features of renal and ureteral calculi the diagnosis is naturally the first. Great advance has been made in this essential factor since Morris wrote, in the second edition of "Surgery of the Kidney and Ureter," 1901, that "a correct diagnosis of stone in the ureter is not to be frequently expected," and, "unless a calculus in the ureter can be felt through the abdominal parietes, the rectum, the vagina, or the bladder, its precise location cannot be ascertained except by an exploratory operation."

This has been changed by perfecting the technic of the X-ray examination, aided, in some cases, by cystoscopy and ureteral catheterization. Though it takes an expert to take good X-ray plates, to show renal and ureteral calculi, and sometimes an expert to interpret them, the X-ray has revolutionized the diagnosis of these conditions.

Under such circumstances there is danger that the pendulum will swing too far, and that the clinical diagnosis will be overlooked or neglected. This is especially regrettable in view of the fact that an X-ray expert is not always available; secondly, because the X-ray fails in certain cases; and thirdly, because in the differential diagnosis from other conditions we must make a probable diagnosis, from the clinical symptoms, to suggest the need of an X-ray plate.

Both of the last two factors were illustrated in the case of Mr. G. M., who had suffered from attacks of gout for several years, and who was brought to the Presbyterian Hospital on August 13, 1905, with the diagnosis of appendicitis and the

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history that he had been suddenly taken with severe pain in the right lower quadrant of the abdomen, radiating up and back to the right lumbar region. There was nausea, but no vomiting, no frequency of micturition, and no blood visible in the urine. There was considerable prostration. The leucocyte count was 14,600; temperature, 99.2° ; pulse, 84. The urine showed a heavy trace of albumin, a few blood-clots, and a considerable number of red blood-cells. At McBurney's point there was marked rigidity, muscular spasm, and tenderness. There was some tenderness in the right lumbar and the right hypochondriac regions. Rectal examination was negative. The clinical diagnosis of renal calculus, probably passing the ureter, was made; and operation on the appendix was refused, in spite of the importunity of friends. The treatment consisted of large amounts of bland water (Poland), and morphine during paroxysms.

August 17: At least one attack of pain has occurred each day, usually at night. Between attacks the patient was comfortable. Blood was present in the urine most abundantly after a severe attack on August 16, during which the pain was referred to the right lumbar and not to the right iliac region. The tenderness in the right iliac region, at McBurney's point, has gradually disappeared, but there is some over the right kidney. To confirm the diagnosis he was taken to an expert radiographer, as the hospital X-ray plant was being repaired. Several perfect plates were taken which showed no stone. On August 18, he had an attack of gout in the left big toe, and on the same day, the fifth day after the onset of the attack, he passed a very small, rough oxalate calculus and all symptoms were relieved.

In this case the slight haematuria, the intermittent character and the severity of the pain, with periods of almost entire comfort between the paroxysms, the position of the tenderness, in addition to that at McBurney's point, and the lack of evidence of inflammation, as shown by the pulse, temperature, and blood-count, taken together made me so sure of the diagnosis that, in spite of the negative X-ray findings, I resisted the appeals of his friends to operate on the appendix.

It is in the differential diagnosis between appendicitis and

renal and ureteral calculi that the clinical diagnosis of the latter is most often of particular importance. It is an excellent rule to examine carefully all cases of appendicitis without typical signs of inflammation for haematuria, and if the latter is found, and sometimes when it is not, to subject them to X-ray examination of the region of the kidney and ureter before operating on the appendix. According to Bevan, blood in the urine is found microscopically in many acute appendicitis cases, but in my experience this is rare. It has been the experience of most surgeons to have operated on cases of supposed appendicitis when a calculus was the actual pathological condition present, or to have operated for calculus when the appendix had previously been removed for the relief of the symptoms.

In the case of Miss T. B., from whose right kidney I removed by nephrolithotomy in July, 1906, an oxalate calculus of the size of a hickory-nut, which was clearly shown in the X-ray plate, this patient was operated on two years before for cystic ovary, retroflexion, and chronic appendicitis. Whether the renal calculus was then a cause of her subjective symptoms I cannot say; but from the chronic history and the condition of the stone I suspect that it was.

In addition to the case first mentioned, I know of several other cases of small calculi failing of detection in the X-ray plate; but larger stones may also fail to be shown in plates taken by an expert, as has been pointed out by Dr. F. Tilden Brown in the case of two uric-acid calculi of some size, and by many others. If the stones are pure uric acid or urates they will probably give no visible shadow, but fortunately they generally contain oxalates, etc., which give a distinct shadow.

In addition to the occasional failure of the X-ray to show a calculus when present, we must be on our guard, in suspected calculi in the pelvic portion of the ureter, against the so-called false shadows. These are now better understood and guarded against, especially if the X-ray is taken with a styled catheter in the ureter in cases of doubt.

An interesting example of this source of error was presented in the case of Mr. R. T., aged 42, admitted to my service in the Presbyterian Hospital, September 1, 1908, with the history that eight months before he had been seized with a very severe stabbing pain in the right lumbar region, radiating to the bladder and penis, with retraction of the right half of the scrotum and frequent micturition. This attack increased in severity for five hours, continued for thirty hours, and suddenly ceased. Similar attacks occurred two days and two weeks later, and during the six weeks before admission four such attacks had occurred, the last one three days before. For the past six weeks he had had an almost continuous bearing-down pain in the hypogastrium, a sense of heaviness in the bladder, frequent desire to micturate, and some rectal tenesmus. He had never passed blood in the urine. For the past eighteen months he had been taking arsenic for what he was told was pernicious anaemia.

Two X-ray plates showed three shadows in the position of the ureter, at about the level of the sacrosciatic ligament. On cystoscopic examination by Dr. Osgood the ureteral catheter passed readily and the instrument failed to reveal the presence of a stone. But the clinical symptoms were typical and the ureteral catheter often easily passes a calculus in the ureter. On operation, September 10, 1908, the ureter, embedded in rather dense cellular tissue, was followed to the bladder. No stone was definitely felt, the adherent cellular tissue rendering palpation uncertain. The pelvic ureter was then opened and a probe, passed toward the bladder, met an obstruction just above it. Another longitudinal incision was made just above the obstruction, but as the stone could not be dislodged upward it had to be removed through a third incision directly over it. It was of the size of a small split pea, but oblong and with a mulberry-like surface. Just below this but outside of the ureter, and apparently outside the pelvic fascia, were two or three free, hard, oval masses. One of these was dug out by the finger, and on subsequent examination by Dr. Osgood it was found that it presented the structure of true bone. These bodies gave at least two of the three shadows in the X-ray plate.

Other sources of extra-ureteral shadows are more common, especially calcified lymph-nodes, and the small ossified areas

in the pelvic ligaments. The latter give small round shadows in the vicinity of the ischial spine, often multiple and frequently bilateral.

Although the position of the ureteral calculus is indicated by the X-ray, yet in the pelvic ureter, owing to its obliquely curving course, the exact position may not be easy to predict from the plate. With calculi in this position I have found it useful to examine and palpate the pelvic ureter through an opening in the peritoneum, which is sutured as soon as the finger within the peritoneum has assisted that without to locate and expose the calculus. This was first practiced through an opening accidentally made in the peritoneum by a retractor, and was found so useful that I have employed it in some cases since then, in one exploration confirming a negative finding. Dr. John H. Gibbon of Philadelphia has also employed and recommended a similar procedure. It would serve a very useful purpose in the exceptional cases mentioned by Bevan, where the symptoms are referred to the side opposite to the stone.

As to calculi in the lower ureter my experience coincides with that of Dr. Moschcowitz, who has reported that he has found them mostly between the pelvic brim and the bladder, and not so much at those two points, where most statistics locate the greater number of calculi in the lower ureter. Although I have observed small vessels crossing this portion of the ureter in all cases, I have not noticed their connection with the arrest of calculi here which Dr. Moschcowitz suggests, though this is a likely cause.

In considering the question of operation in ureteral calculi it is important to remember to give the calculus a chance to pass the ureter provided that (1) it is not too large, (2) it has not remained long in the ureter, (3) there is no infection. In cases such as that of Mr. G. M., related above, time should unquestionably be given for the passage of the calculus, unless the pain is so frequent or so severe as to exhaust the patient.

Another patient, a young man, Mr. H. P., whom I saw in August, 1908, had had a typical attack of renal colic, and an X-ray showed a shadow in or near the course of the upper part

of the pelvic portion of the left ureter. Although advised to have another X-ray with a styled catheter in the ureter, he did not return until driven by another attack in November, when another X-ray showed the shadow lower. The ureteral catheter would not pass more than $\frac{1}{2}$ - $\frac{3}{4}$ inch up the left ureter, and the left ureter opening appeared oedematous, as seen through the cystoscope. Within a fortnight he passed the stone.

X-ray plates taken at intervals are very useful to indicate whether the calculus is passing or is stationary.

The X-ray is also very serviceable in enabling us to determine from the size of the calculus whether it is likely to pass or not. If distinct infection occurs operation should not be deferred, for the kidney and ureter will be progressively damaged.

In cases of renal calculus we have the choice between pyelotomy and nephrolithotomy. If there is no infection of the kidney or pelvis, pyelotomy is the operation of choice for single stones in the pelvis that are of moderate size and not very irregular, as Bevan has pointed out.¹ Thus in the case of W. S., a large stout man, aged 45, who was operated on by me at the Presbyterian Hospital, July 7, 1905, the right kidney could not be delivered through the wound. Without an extremely large incision, to allow the introduction of the hand to control the vessels, nephrolithotomy was far inferior to pyelotomy, for the stone could be plainly felt in the pelvis, and it was removed and the pelvis sutured without great difficulty. There was no leakage of urine.

Where there is infection of the pelvis or kidney and drainage is indicated I prefer nephrolithotomy, through an incision about 1 cm. behind the outer border of the kidney. Personally I have had no trouble with hemorrhage in the latter operation, for the vessels are controlled by the pressure of the fingers until they are secured by the catgut sutures. The only severe hemorrhage that I have had in operations on the kidney has been the result of freeing the kidney from the capsule,

¹ Transactions of the Am. Surg. Asso., 1908.

where the latter was so adherent to the fatty capsule as to make the extracapsular exposure of the kidney not feasible.

After the removal of ureteral calculi through an extra-peritoneal incision I have always closed the latter by two or three sutures of fine catgut without making a carefully exact closure or using two rows of sutures. I do not know that the sutures employed have served any useful purpose, for there has usually been some leakage of urine. If the ureter is not much dilated it acts as a capillary tube and suture is hardly necessary.

As in any case leakage of urine may occur I have always used drainage after opening the ureter. One experience with drainage is instructive as showing the danger of the use of a rubber tube instead of a cigarette or rubber-tissue drain. In the case of R. T., mentioned above with the history of a progressive or pernicious anaemia for eighteen months, the cigarette or rubber-tissue drain was replaced by a rubber tube on the sixth day after operation. This was removed six days later because there was considerable oozing of blood through the tube and several clots were passed through the urethra with considerable pain. He did well until five days later, when there was a fresh hemorrhage from the sinus and into the bladder. In spite of saline infusion and direct transfusion of blood he died the same day, the poor condition of his blood making him unusually susceptible to the loss of a moderate quantity of blood. I attributed the hemorrhage in this case to the use of the rubber drainage tube and would strongly advise against its use. This advice is strikingly reinforced by the case recently reported² by Dr. Moschcowitz, where, after the removal of bilateral ureteral calculi rubber drainage tubes caused a pressure necrosis of both external iliac arteries, necessitating their simultaneous ligation, which was successful.

I have seen a fatal hemorrhage from the erosion of mesenteric vessels by a rubber tube in an abdominal abscess, secondary to appendicitis; and I do not think it safe to have rubber drainage tubes for long in abdominal cases, where the respiration

² Annals of Surg., Dec., 1908.

tory and peristaltic movements of the contents may cause the tube to erode a large vessel.

A final point of great interest and importance is the question of the ultimate results in cases where renal or ureteral calculi are associated with infection of the kidney and ureter. Where the infection is recent or moderate it commonly subsides soon after all calculi are removed. But how is it where the ureter and the pelvis of the kidney are distended with pus or the kidney tissue is largely replaced by abscess cavities? There is hope for complete recovery or a return to a useful and comfortable condition even in these cases. These two varieties of results are illustrated by the two following cases.

In the case of Mrs. M. C., 32 years old, who entered the Presbyterian Hospital January 8, 1908, there had been left renal colic at intervals of a week to a month for a year, commencing two years ago. The sharp pain radiated from the left lumbar region toward the external genitals and the inner side of the thigh, lasted about half an hour, and was relieved on lying down. Then there was an interval free from attacks until four weeks ago, when there was a severe attack of left lumbar pain, repeated every two to three days for two weeks, with some chills, vomiting, and night sweats. She had never noticed blood or gravel in the urine. For the last two weeks there had been some soreness over the bladder and sharp pain at the onset of micturition. There was a daily rise of temperature, and the urine on examination contained a little pus and a few red blood-cells. A catheter specimen gave a pure culture of colon bacilli, no tubercle bacilli. The X-ray shows a small stone, about the size of a date seed, at the upper end of the ureter. This was removed by operation on January 21, through a left lumbar extraperitoneal incision. After incising the ureter over the stone, about two inches from the pelvis, it was removed and pus followed the stone, and the amount of pus was much increased on pressing the kidney. As the pelvis and calices were much distended with pus an incision was made into them through the outer border of the kidney for drainage. The tube was removed on the eleventh day. The ureter was not sutured. The pus from the kidney gave a pure culture of colon bacillus. A month later there was only a small shallow sinus

which soon healed. I saw her eight months later, when the urine was normal, she was in blooming health, and was several months pregnant. Probably the marked infection had occurred at the time of the attack, about six weeks before the operation, so that the kidney tissue had not had time to suffer greatly from infection, nor had it atrophied appreciably from the distention of the pelvis. A complete cure resulted here.

The other extreme of infection and a more serious condition was present in the case of Mrs. S. S. 44 years old, who was admitted to the Presbyterian Hospital, October 31, 1906. For twenty years, at intervals of about four months, she had suffered from colic, which began in the right lumbar region and radiated to the right lower quadrant of the abdomen and the outer aspect of the right thigh. There was no nausea or vomiting, no stone had passed, and no blood was noticed in the urine, but the latter had been cloudy for the past fifteen years. In March, 1906, I operated on her right kidney in Bellevue Hospital. The right kidney was much enlarged and displaced downward and was readily palpable. It was incised along the outer border and three stones removed. One of these, as large as an egg, had a stem-like process which had projected down the ureter. A part of this stone had apparently been chipped off and rubbed against the larger fragment until the opposed surfaces were worn smooth. It was shown at a meeting of the New York Surgical Society. The calices were much distended with pus, and the kidney tissue greatly atrophied. The kidney was drained and a sinus persisted up to the second operation. Up to October, 1906, there remained a dull pain in the right lumbar region, radiating to the right lower quadrant and the inner aspect of the thigh, and increased by movements of the body. About once a week the pain has been more sharp. Frequent micturition has been present, but no gravel has passed. The right kidney is palpable throughout, somewhat enlarged, and not tender. The urine contains much pus, red blood-cells, but no tubercle bacilli. On account of the condition of the right kidney I had about determined to do a right nephrectomy, but the X-ray showed not only a medium-sized calculus in the right kidney, but also several calculi on the left side. Also the ureteral catheterization and the examination of the separate urines showed the right kidney to be functionally more healthy than the left. Hence a right nephrotomy was again done on

November 8, 1906, and a calculus the size of an olive pit and several the size of grape seeds were removed. Two pockets of pus were opened up and the kidney drained.

November 24, the left kidney was noticed to be enlarged and tender, and the patient has complained more and more of left lumbar pain and is losing ground, though she improved for a time after the operation. As this condition did not improve a nephrotomy was done on the left side, December 6, 1906, and three or four calculi, scattered through the pyonephrotic kidney, were removed. As there was an area of fairly normal kidney tissue at one point, though most of it was atrophied or destroyed, no nephrectomy was done. The kidney was drained. For a time there was a profuse discharge of pus, and some urine, from the left kidney. On December 20 it was noted that she voids from 25 to 40 ounces of urine a day with only a trace of albumin, and that the patient's condition was much improved. During convalescence the sinus on the right side closed, but was opened again on January 23, 1907, and two ounces of thick yellowish pus evacuated. On February 11, when she left the hospital, she was fairly strong, and there was only a moderate discharge from the two sinuses.

The bacteriological examinations had showed *Staphylococcus pyogenes aureus* from the two ureters, the right kidney, and the lumbar sinus; and streptococcus from the left kidney. There were no tubercle bacilli. The leucocyte count was 16,400 on November 1 (poly's, 77.5 per cent.), 11,000 on November 12, and 16,600 on November 25.

Though she was relatively greatly improved when she left the hospital she was still very anaemic and weak, though she had no pain. She was cared for partly in the accident ward and partly by a visiting nurse and gradually gained strength so that after a few months she was able to undertake her former housework for her large family. This amount of improvement we hardly expected when she left the hospital, the most that we hoped for was that she would be comparatively comfortable and not a burden to others. Several other cases with a less degree of infection than either of these two cleared up almost at once with the treatment given in all cases, *i.e.*, urotropin, bladder irrigation if necessary, and sometimes bacterial vaccines.

From the last case we see that even in advanced and neglected cases, by conservative treatment, saving the kidney tissue that is left, instead of doing a nephrectomy as the best way to avoid a sinus, we may hope to restore a useful degree of health. This has an important bearing on the question of nephrectomy in the presence of extensive trouble on the other side. By estimating the condition of and the work done by the other kidney, by examining the separate urines, we avoided removing the better of two poor kidneys, where what was left of both was necessary. Of course if the other kidney had been healthy nephrectomy would have been the proper operation.